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FOUR NEW SPECIES OF *PARATHEUMA* (ARANEAE, DESIDAE) FROM THE PACIFIC

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ABSTRACT

Four new species of *Paratheuma* are described from the Cook, Fiji and Tuamotu Islands and Australia. New records of *P. armata* are presented. Possible relationships among species of the genus are suggested.

INTRODUCTION

In a recent paper (Beatty and Berry 1988) we illustrated and discussed the three known species of the genus *Paratheuma* Bryant. Here we report the rather surprising subsequent discovery of four new species of the genus from Australia and the Cook, Fiji and Tuamotu Islands of the South Pacific.

Like the other species, these were taken near the high tide level on seashores, often among loose broken coral thrown up on the beach. However, we found some individuals under large non-coraline rocks, and others in crevices or holes in outcrops of volcanic or conglomerate rocks a few cm to about one meter above normal high tide level.

The previously known species of *Paratheuma* are *P. insulana* (Banks) from Bermuda, Florida, Cuba and Haiti (Banks 1902, 1903; Beatty and Berry 1988; Bryant 1940; Platnick 1977), *P. interaesta* (Roth and Brown) from the northern part of the Gulf of California (Beatty and Berry 1988; Platnick 1977; Roth and Brown 1975), and *P. armata* (Marples) from Swains Island, Marshall Islands and Caroline Islands in the Pacific (Beatty and Berry 1988; Marples 1964). The four new species are quite similar to these in size, shape, coloration and setation, as well as habitat.

We have already described (Beatty and Berry 1988) the range of coloration in the genus, and the additional species add little to this range. A few of the recently collected specimens, almost black on the abdomen, are darker than any we had

seen earlier. The light abdominal chevrons occasionally present are more distinct in some specimens than our previous description suggests.

Size and proportions of all species show so little variation that we have presented only a few measurements in the descriptions below. Three adult males and three adult females of each species were measured, except for *P. andromeda*, of which we had only one male.

We have not described the bristle pattern for each species individually, largely because the bristles are weak, not very abundant, and vary little among species. Instead, a separate description is presented, which applies equally well to all the Pacific species. These "bristles" are, of course, setae, but the presence of three main size classes of setae in spiders makes retention of the commonly used terms, "hairs, bristles and spines" useful for distinguishing among them.

DESCRIPTIONS

Setation.—All five of the Pacific *Paratheuma* have the same arrangement of bristles, with no more variation among the species than within a single population of one of them. There is almost no difference in the pattern between males and females. In the following description a bristle number indicated as 1-3 means one to three bristles; 1-2-3 means one proximal bristle, two near mid-length, and three distal, on a particular appendage surface.

Palp.—Two dorsal bristles on femur, in distal half; two dorsal on patella, one proximal, one distal; two prolateral and one dorsal on tibia; on tarsus, two prolateral and two retrolateral near base (the retrolateral pair absent in adult males), a pair just distal to mid-length of tarsus, one on each side, another such pair at distal end, and two distal ventral bristles in the mid-line.

Legs.—*Femora*: In both sexes on all legs, 1-3 dorsal, 1 dorsolateral. Dorsolateral bristle dorsoprolateral on legs I-II, dorsoretrolateral on III-IV. *Patellae*: Two dorsal (one proximal, one distal) on all legs in both sexes. *Tibiae*: Leg I, 1-2 dorsal, 2-3 ventral. Leg II, 2 dorsal, 1 prolateral, 2 ventral. Leg III, 1-(0-2)-3 dorsal, 1-1-1 ventral. Leg IV, 1-2-3 dorsal, (1-2)-(1-2)-(1-3) ventral. *Metatarsi*: Legs I and II, 5-6 ventral arranged (1-2)-2-2. Leg III, (0-1)-2-2 dorsal, 2-2-3 ventral. Leg IV, 2-2-2 dorsal, 2-2-3 ventral.

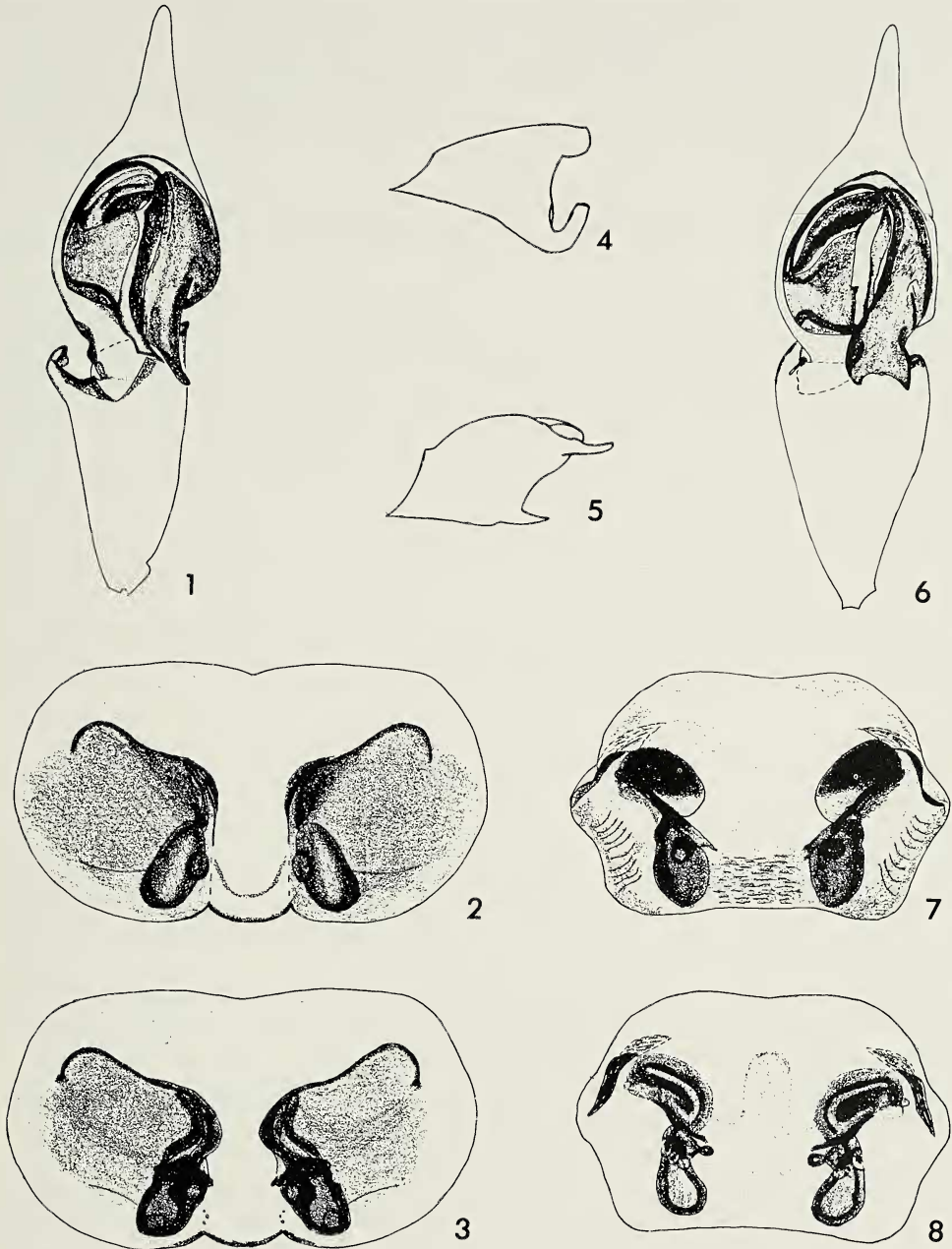
Juvenile specimens listed below are not to be regarded as paratypes. Holotype males and one paratype female of each species are deposited in the Bishop Museum, Honolulu. All other material examined remains in the possession of the authors.

Paratheuma andromeda, new species

Figs. 1-4

Holotype.—Male from Cook Islands, Aitutaki, Rapota Motu, in crevice in volcanic rock outcrop on shore, 5 June 1987 (J. W. Berry), in Bishop Museum, Honolulu, Hawaii, USA. The name *andromeda* is a noun in apposition after Andromeda of classical mythology.

Diagnosis.—Male: The broad tibial apophysis of the male palp, curving dorsally and toward the cymbium (Fig. 4) clearly distinguishes *andromeda* from



Figs. 1-8.—Left male pedipalp and epigynum of *Paratheuma* species: 1-4, *P. andromeda* from Aitutaki, Cook Islands; 1, pedipalp, ventral; 2, epigynum, ventral; 3, epigynum, cleared, dorsal; 4, tibia of pedipalp, lateral; 5-8, *P. ramseyae* from Rarotonga, Cook Islands; 5, tibia of pedipalp, lateral; 6, pedipalp, ventral; 7, epigynum, ventral; 8, epigynum, cleared, dorsal.

all other species of the genus. The length and orientation of the distal processes of the conductor (Fig. 1) are also distinctive.

Female: The large ovate seminal receptacles distinguish this species from all others except *P. ramseyae*. From the latter *andromeda* differs by having the entire

anterior margin of the epigynal depressions sclerotized, and by lacking the heavily sclerotized pouch around the epigynal openings (Figs. 2-3).

Additional descriptive notes.—Male: Total length 3.8 mm, carapace length 1.7 mm, maximum carapace width 1.1 mm. Embolus originating at mid-length of bulb, curving around anteromedial margin of bulb, turning back to end in hairfine filament on conductor. Two rather long narrow distal processes of conductor almost parallel with long axis of tibia, curving slightly laterally (Fig. 1). Tibial apophysis of palp broad, curving strongly dorsally and toward cymbial base (Fig. 4).

Female: Total length 4.1-4.4 mm, carapace length 1.7-1.8 mm, maximum carapace width 1.2-1.3 mm. Epigynum with narrow sclerotized rim along entire anterior length of depressions, curving short distance along lateral margin. Broad heavily sclerotized ducts leading from openings to large ovate seminal receptacles.

Distribution.—Known only from a small area of volcanic shoreline on one islet of Aitutaki, Cook Islands, and from the shore of a nearby islet. The apparently very restricted distribution of this species is unusual for the genus, though it is possible that it occurs on other main islands of the Cook group. A large percentage of the shoreline of the Aitutaki Islands was searched, without success, for additional specimens.

Specimens examined.—**COOK ISLANDS:** *Aitutaki*; Moturakau, in coral rubble on beach, 28 March 1987 (J. W. Berry), 1 female, 1 immature; Rapota Motu, in crevices and holes in volcanic and conglomerate rock at shoreline, 5 June 1987 (J. W. Berry), 1 male, 2 females.

Paratheuma ramseyae, new species

Figs. 5-8

Holotype.—Male from Cook Islands, Rarotonga, Koromiri Islet, in broken coral rubble on beach, 3 April 1987 (J. W. and E. R. Berry), in Bishop Museum, Honolulu, Hawaii, USA. The species is named after Elizabeth Ramsey Berry, who discovered it.

Diagnosis.—Male: Distal end of conductor broad, with two short, bluntly pointed processes that curve slightly toward tibia (Fig. 6). Tibial apophysis slender, curving dorsally and toward cymbium (Fig. 5).

Female: Distinguished from all other species by the short anterolateral sclerotizations of the epigynal depressions, and the large hoodlike sclerotized pouches around the epigynal openings (Figs. 7-8).

Additional descriptive notes.—Male: Total length 3.3-3.9 mm, carapace length 1.6-1.8 mm, maximum carapace width 1.2-1.3 mm. Embolus of palp as in other species described here. Other palpal characters as in diagnosis.

Female: Total length 3.6-4.5 mm, carapace length 1.7-1.8 mm, maximum carapace width 1.3 mm. Sclerotizations of rim of epigynal openings short and sigmoid, located in anterolateral portions of depressions only. Openings leading into large sclerotized pouches. Short ducts from pouches to large ovate seminal receptacles.

Distribution.—Cook Islands, Rarotonga. Known from the main island of Rarotonga itself, and from four small islets inside the fringing reef.

Specimens examined.—**COOK ISLANDS:** *Rarotonga*; Ngatangia Harbor beach, in rock outcrops, 31 March 1987 (J. W. Berry and J. A. Beatty), 1 female, 1 immature; Koromiri Islet, in broken coral rubble on sand beach, 3 April 1987 (J. W. Berry and E. R. Berry), 2 males, 1 female, 8 immature;

Koromiri Islet, in coral rubble, 4 April 1987 (J. W. and E. R. Berry), 1 male, 1 female, 5 immature; Koromiri Islet, in coral rubble, 6 April 1987 (J. W. and E. R. Berry), 3 females, 28 immature; Oneroa Islet, in beach litter, 21 March 1987 (J. W. and E. R. Berry), 1 female, 2 immature; Taakoka Islet, in crevices on volcanic rock outcrop at shore, 19 March 1987 (J. W. Berry and J. A. Beatty), 1 male, 2 females; on offshore islets at Muri Beach, 27 March-1 April 1987 (J. W. and E. R. Berry), 3 males, 1 female, 3 immature.

Paratheuma australis, new species

Figs. 9-12

Holotype.—Male from Fiji, Viti Levu, Korotongo village, shoreline at Reef Resort, in coral rubble, 21 May 1987 (J. W. Berry and E. R. Berry), in Bishop Museum, Honolulu, Hawaii USA. The name *australis* is an adjective based upon the more southern range of this species, compared with most others in the genus, and its occurrence in Australia.

Diagnosis.—Male: Palp with slender erect tibial apophysis of medium length, as in *P. insulana* and *P. rangiroa*. Distinguished from *insulana* by its broader cymbium and palpal bulb, from *rangiroa* by the more anteriorly directed tibial apophysis and the shape of the conductor tip.

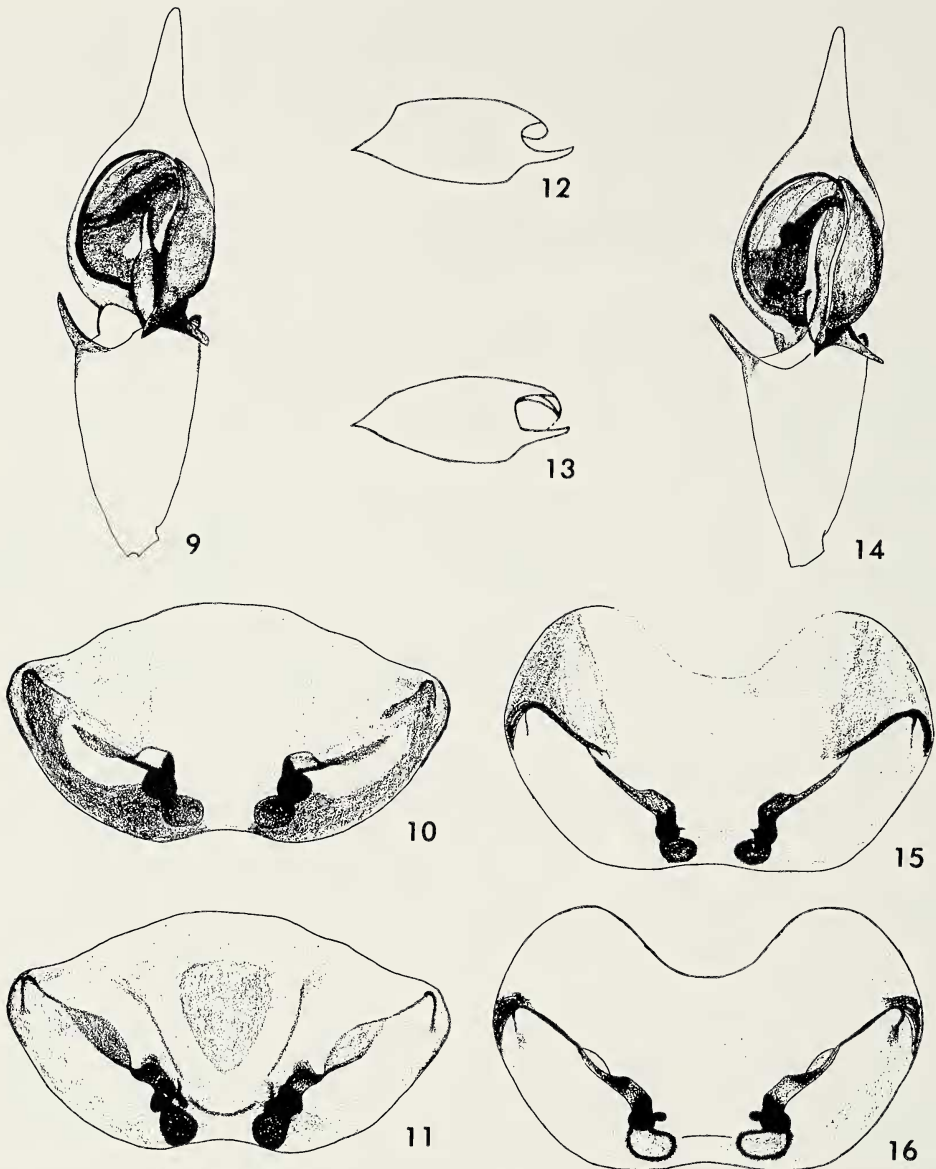
Female: With narrow oblique epigynal depressions, as in *P. insulana* and *P. rangiroa*. Distinguished from *insulana* by reduction of the anterolateral hoods of the epigynal depressions. See discussion under *P. rangiroa* for differences from that species.

Additional descriptive notes.—Male: Total length 3.2-3.5 mm, carapace length 1.5-1.7 mm, maximum carapace width 1.1 mm. Embolus originating on medial side of bulb near mid-point of bulb's length, slender, tapering, curving in broad parabola to end in filament lying under edge of conductor. Tibial apophysis about 1/5th length of cymbium, directed forward at slight angle to axis of tibia, slender and curving slightly dorsally (Fig. 12). End of conductor broad, extended into two angular processes, one directed backward and slightly medially, one longer, extending laterally (Fig. 9).

Female: Total length 3.4-4.2 mm, carapace length 1.5-1.7 mm, maximum carapace width 1.0-1.1 mm. Epigynal depressions pale, extending obliquely forward and laterally, with only short narrow sclerotized rim anterolaterally. Openings at anterior medial edge of depressions, leading to short looped ducts ending posteriorly in pair of small receptacles (Figs. 10-11).

Distribution.—Fiji Islands and Australia.

Specimens examined.—AUSTRALIA: QUEENSLAND: Great Keppel Island, Leek's Beach, in coral rubble, 24 April 1987 (J. W. and E. R. Berry), 2 males; Monkey Beach, in coral rubble, 24 April 1987 (J. W. Berry), 4 immature; Yeppoon, Wave Point, among granitic rocks on beach, 23 April 1987 (J. W. and E. R. Berry), 1 male, 2 females, 7 immature. FIJI: Viti Levu; Nadi, Nadi Bay, in beach rubble, 29 April 1987 (J. W. and E. R. Berry), 1 male, 1 female; Nadi Bay, in gravel on beach (J. W. and E. R. Berry), 1 male, 4 immature; 2 km W of Vatukarasa, on beach among small coral rocks, 12 May 1987 (J. W. Berry), 1 female; Korotongo village, shore at Reef Resort, in coral rubble, 21 May 1987 (J. W. and E. R. Berry), 2 males, 2 females, 6 immature; 0.5 km E of Komave village, in coral rubble on beach, 24 May 1987 (J. W. and E. R. Berry), 1 male, 2 females, 21 immature.



Figs. 9-16.—Left male pedipalp and epigynum of *Paratheuma* species: 9-12, *P. australis* from Viti Levu, Fiji Islands; 9 pedipalp, ventral; 10, epigynum, ventral; 11, epigynum, dorsal, cleared; 12, tibia of pedipalp, lateral; 13-16, *P. rangiroa* from Rangiroa, Tuamotu Islands; 13, tibia of pedipalp, lateral; 14, pedipalp, ventral; 15, epigynum, ventral; 16, epigynum, cleared, dorsal.

Paratheuma rangiroa, new species

Figs. 13-16

Holotype.—Male from Tuamotu Islands, Manihi, Topihairi Islet, in beach rubble, 3 June 1987 (E. R. Berry), in Bishop Museum, Honolulu. The name is a noun in apposition after the atoll where the species was first found.

Diagnosis.—Male: Palp with slender erect tibial apophysis of medium length, as in *P. insulana* and *P. australis*. Distinguished from *insulana* by its broader

cymbium and palpal bulb, from *australis* by the more laterally directed tibial apophysis and the shape of the conductor tip, the medial projection of which is smaller and the lateral projection longer than in *australis*.

Female: With narrow oblique epigynal depressions as in *P. insulana* and *P. australis*. Distinguished from *insulana* by reduction of the anterolateral hoods of the epigynal depressions, from *australis* by the longer sclerotized rim of the depressions and the somewhat larger and more oblong seminal receptacles.

Discussion: This species is genitally quite similar to *P. australis*. It is smaller than *australis*, and the genitalic differences, though slight, are constant in the available material. The presence of three more quite distinct species of the genus on islands between the ranges of *rangiroa* and *australis* argues for their distinctness. Comparison of these two species by electrophoresis of proteins from whole body extracts (Laemmler 1970, for method) showed clear differences.

Additional descriptive notes.—Male: Total length 2.7-2.8 mm, carapace length 1.3-1.4 mm, maximum carapace width 0.9-1.0 mm. Palp as in *P. australis* except for differences noted in diagnosis (Figs. 13-14).

Female: Total length 3.1-3.7 mm, carapace length 1.4-1.6 mm, maximum carapace width 1.0-1.1 mm. Epigynum as in *P. australis* except for differences noted in diagnosis (Figs. 15-16).

Distribution.—Known only from Rangiroa and Manihi Atolls in the Tuamotu Islands of French Polynesia.

Specimens examined.—FRENCH POLYNESIA: Tuamotu Islands; Rangiroa Atoll, on lagoon beach near airport, 17 January 1987 (J. W. and E. R. Berry), 1 female, 1 immature; Avitorua Islet, in beach rubble, 5 June 1987 (E. R. Berry), 1 male, 10 females, 18 immature; Manihi, Topihairi Islet, 3-4 June 1987 (E. R. Berry), 6 males, 3 females, 23 immature.

Paratheuma armata (Marples)

New records.—FRENCH POLYNESIA: SOCIETY ISLANDS; *Moorea*, Paopao village, in intertidal coral rubble, 10 January 1987 (J. W. Berry), 1 male, 1 female, 5 immature; Paopao village, in coral rubble on beach (E. R. Berry), 2 males, 6 females; Paopao village, beach rubble, 19 February 1987 (J. W. and E. R. Berry), 2 males, 4 immature; Paopao village, beach rubble, 22 February 1987 (J. W. Berry), 1 male, 2 females; west side of *Moorea*, in pile of supratidal rocks along shore, 13 January 1987 (J. W. and E. R. Berry), 2 males, 7 immature; *Tahiti*, Faaa, in coral rubble on beach, 20 February 1987 (J. W. and E. R. Berry), 7 immature; Faaa, in coral rubble on beach, 9 June 1987 (J. W. and E. R. Berry), 1 male.

SPECIES RELATIONSHIPS

We are not familiar enough with other members of the family Desidae to select a genus as the probable nearest relative of *Paratheuma*. (Also, the contents of the family seem not clearly determined at present). Consequently we do not feel justified in identifying specific character states as primitive or derived.

Within the genus, *australis* and *rangiroa* appear to be the most closely related pair of species, and both are rather similar to *insulana* from the Caribbean. This suggests a vicariant relationship between *insulana* and the pair of Pacific species. As judged by female genitalia, *andromeda* and *ramseyae* seem close to each other, as would be expected by their geographic proximity. The other two species, *armata* and *interaesta*, are more distinctive and do not appear to have any close relatives among the known species of the genus.



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Fig. 17.—Distribution of *Paratheuma* species in the Pacific.

The distributions of all known Pacific species of *Paratheuma* are entirely on or extend only slightly beyond the borders of the Pacific crustal plate (Fig. 17). Given the usually accepted view that all the islands on this plate have always been highly isolated, dispersal must have been of primary importance in the evolutionary history of the Pacific *Paratheuma*. Judging from our recent experience, however, there is a strong possibility that several, perhaps many, more species of the genus await discovery, and their distribution and characters may change our interpretation of their relationships and history considerably.

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